ORGANIZED FARMERS: SPATE IRRIGATION IN BALOCHISTAN

Frank van Steenbergen[1]

1. Farmers and government in spate irrigation in Balochistan

This paper discusses the management of spate irrigation in Balochistan (Pakistan). It discusses the role of the government, particularly in financing construction, operation and maintenance of the spate systems; it discusses the role of organized farmers in these functions; and pays special attention to enabling laws, and their effectiveness, for enforcing rights to spate water and for formalizing farmer organizations. It concludes with a perspective on improved participatory management of spate irrigation systems in Balochistan.

There are a number of reasons to pay attention to spate irrigation in Balochistan. It is an arid region with occasional rainfall events. Plains border highlands, giving rise to spate systems that vary from small to very large, from very episodic to almost semi-perennial. Spate irrigation provides the economic basis (though often in combination with other sources of livelihood) for a substantial - and often poor - part of the rural population. A third of the irrigated area is under spate; of the remaining area a substantial part is dependent on groundwater exploitation, which is no longer sustainable.

The paper is organized as follows. Section 2 puts spate irrigation in Balochistan in perspective, by giving a typology and discussing the marginal nature of the farming systems. The role of government in the development and operation of the spate systems has been fairly limited in Balochistan, and by default much of the management is done by farmers. The roles of government and of the organized farmers are discussed in more detail in sections 3 and 4 respectively. On the basis of that discussion, section 5 approaches the question of improved participatory irrigation management.

2. Typology

Balochistan is the largest, but least populated (12 person per sq. km.) of four provinces in Pakistan. Its uniform aridity (nowhere exceeding 400 mm on average annually, but in many parts as low as 50 mm annually) makes unirrigated agriculture impossible. According to the Agricultural Census the area under run-off and spate irrigation fluctuates between 30,000 and 150,000 ha. The areas under canal irrigation and minor (including groundwater) irrigation each are comparable and are 140,000 ha.

Spate irrigation (called sailaba in Balochistan) is distinct from other rain-dependent production systems, particularly water harvesting (called khuskaba in Balochistan), in that the catchment of spate systems is bigger and water is diverted from river beds, instead of being collected from hill slopes or in-field. The dividing line between the smaller spate diversion systems and some of the larger run off complexes is often arbitrary, however. The farming systems and water conservation practices are similar, but the reliability in spate diversion systems is higher.

Spate diversion systems themselves differ widely. The main parameters are hydrological (catchment characteristics, rainfall pattern), geographical (location and level), hydraulic (type of diversion and size of command area) and sociological (land tenure, social structure and degree of public intervention). A useful distinction at this point is the difference between highland and lowland systems (see also table 1).

Highland systems, found in the Khurasan Range, on the eastern slopes of the Sulaiman Range, and the Central Brahui Range in Balochistan, generally have small catchments. Due to the small size of the catchments the spates are of short duration, usually lasting from one hour to one day. They are often

[1] Arcadis Euroconsult, PO Box 441, Arnhem, The Netherlands; email fvansteenbergen@compuserve.com

difficult to control, because the slopes are relatively steep in highland areas and because only coarse material is available to build diversion structures. Similarly, the distribution of water within the system tends to follow the law of gravity more than elaborate distribution rules.

The lowland systems, on the other hand, that are common in the vast Kacchi Plains as well as in Las Bela and the Kharan basin in Balochistan, have large catchments and very shallow gradients. The flow lasts several days and can even be semi-perennial. Usually the floodwater moves slowly. It is often controlled by earthen barrages, but deflecting spurs and free intakes - similar to those in the highlands - are found as well. The low velocity flow and its long duration have resulted in extensive rules on water allocations. The flood rivers in the lowlands have often created their own plains of fine soils. Due to the soft material and due to low gradients, the sustainability of the systems is constantly threatened by excessive silt deposition and subsequently breaches of the riverbank.

The distinction between highland and lowland systems is not absolute. Lowland systems with small catchments or in the upper reaches of flood rivers on the plains share many of the characteristics of the highland systems. On the other hand, highland systems in more temperate climatic zones, where precipitation is gentle and spread over a longer period, conform in some respects to the description of the lowland systems.

TABLE.1: Typology of spate irrigation systems

	Highland systems	Lowland systems
Catchment	Limited	Large
Bed material	Stony, coarse	Sandy, fine
Gradients	Steep	Gentle
Flow	Flash floods	Semi-perennial
Diversion structures	Free intakes	Also barrages
Water distribution	Simple, 'natural'	Complex, 'manipulated'

All spate diversion systems in Balochistan, however, are marked by intrinsic uncertainty in water supplies and related to this, a marginal agricultural production system. The uncertainty in water supplies comes in two shapes. The first is the recurrent uncertainty. Water availability differs widely between the years: there are either no floods or several floods. The floods may be too violent to control and may wipe out diversion structures in one year; and in the next years the floods may be mild and controllable.

The second element of uncertainty is the dynamic character of the spate irrigation systems. In the medium-term the configuration of the spate systems changes: the bed levels of the spate rivers, the flood channels and the fields changes and the intake structures need to be adjusted. As a result of this dynamic nature some areas go out of command because the flood channel silts up or because it scours out so much that the flood can no longer be controlled and other areas become easier to irrigate. In the worst case entire systems are lost, because the river changes its course.

Spate irrigated areas in general also support a low value agriculture. The recurrent uncertainty in water supplies lies at the root. There may be either too much or too little spate flows. In the first case the spates may be beyond control, breaking the diversion structure or the flood channels, before land is irrigated.

In the alternative scenario, the season may not bring any flood or only a very small flood, that peters out before it irrigates all fields. A variation on these problems is that the downstream water users are deprived, because upstream users monopolize the flow. A further source of insecurity is the additional moisture from rains at later stages of crop growth, particularly of wheat. These rains may not come and the crop may be suitable for fodder only.

The farming systems are dominated by drought resistant, low yielding sorghum, millet, wheat, pulses, cotton and oilseeds. Most of the land is under local cultivars. Even if optimal conditions were to prevail, crop returns would have difficulty competing with alternate sources of income.

In addition to the above there is the sensitivity to crop diseases. In general, in flood-irrigated areas, especially adapted local varieties are grown. The timing of the flood determines the crop choice and there is little room to maneuver. This results in monocultures and the impact of pests can be dramatic. Yet there are very few substitutes for the varieties used and agricultural research has concentrated on perennially irrigated crops. Vulnerability is further increased as flood irrigation farmers generally lack the financial resources to apply pesticides.

As a consequence, crop yields from spate agriculture in Balochistan are low. They typically range between 450-900 kg / hectare for wheat, 360-550 kg / hectare for sorghum, 200-500 kg / hectare for pulses, 360-620 kg / hectare for cotton and 150-350 kg / hectare for oilseeds (Mu'Allem 1987; IAN MACDONALDS 1987a; 1987b; Shah 1989). A related phenomenon, peculiar to several flood irrigation areas is that there are landowners who are 'too poor to farm'. They lack the draught animals or mechanical traction to prepare the land and repair the field bunds, and do not have the cash to buy seeds and may have lost their credibility with moneylenders. They are often forced to rent out their land to tenants, who have access to these means of production.

Outmigration is the next step. With alternative labor markets developing and standards of living rising, the movement to other areas has accelerated. This trend has sometimes been self-reinforcing, in particular in the lowland systems of Kacchi, Las Bela and Kharan, as at a certain point the number of able-bodied farmers that stayed behind was insufficient to rebuild the labor-intensive diversion works. In the absence of bunds on the river, the riverbed regresses, making the diversion of water even more difficult, causing further depopulation and ultimately the abandonment of the spate system, as the critical mass for maintenance is lost. This process of depopulation can go very fast: when in the Mirpur area water supplies were reduced because farmers upstream refused to break their bunds, the area depopulated in a matter of three years and most of the spate infrastructure became dysfunctional. In some areas the danger of depopulation is countered by tying labor to the land. The most important manifestation is the hereditary tenancy that is widespread in the Brahui Mountains. In these areas, tenants were given hereditary land rights, on the condition that they would perpetually maintain the field bunds.

3. Government involvement

Investment in irrigation in Pakistan has been dominated by perennial irrigation. Spate irrigation received relatively less attention, because of the general lower rates of returns and the difficulty of making it work technically. The motivation to invest in spate irrigation was sometimes secondary to the spate systems themselves: the public investments were justified on the basis of groundwater recharge or flood protection. Even so 74 permanent structures were constructed in the past decades in Balochistan, making up one-third of the portfolio of the Irrigation and Power Department in the Province. Most of these concerned either earthen, brick or concrete headworks. The failure rate of spate structures, however, has been high. An extensive evaluation of 47 schemes, constructed by the government of Balochistan in the last thirty years, found that only 34% still functioned satisfactorily (see table 2). The

other systems have either become unusable or suffer from serious operational problems (Groundwater Consult 1991).

TABLE 2 Performance of government-constructed spate schemes in Balochistan

Date of construction	Functional	Serious operational problem	Out of order
Prior to 1973	7 (35%)	6 (30%)	7 (35%)
1974 to 1983	4 (29%)	2 (14%)	8 (57%)
After 1984	5 (38%)	7 (54%)	1 (8%)
Total	16 (34%)	15 (32%)	16 (34%)

Source: Groundwater Consult 1991

The overriding factor behind the high proportion of failures in Balochistan was the inappropriateness of the prevailing engineering concept, which was based on controlling the flow at a single point with heavy civil engineering works rather than managing the inherently varying flood rivers. The technical designs for spate systems resembled those for perennial flows, and did not accommodate the capricious nature of the spate systems. Some structures were not able to withstand the force of the violent peak floods. In other cases, headworks were by-passed by the braiding river. Moreover, the provisions for sediment transport were generally insufficient and the intakes silted up (Morton and van Hoeflaken 1994). Trying to avoid these pitfalls would have required substantial investments in large headworks, complex silt excluding devices and long marginal bunds. Though, with these investments, it would have been possible to control the rivers at a single point, the low returns to sailaba cultivation ruled against such high investments.

Besides, in a number of cases newly constructed spate irrigation systems were not utilized due to conflicts on the spate water rights[2]. To invest in a single permanent off-take compatible with the existing 'reactive' rights (further discussed in section 4) and allocation rules on a river system is extremely difficult, since existing practices do not create predictable entitlements, but at best certain probabilities of irrigation. By improving the water supply to one area, there is a fair chance that someone will be worse off somewhere else at least under some circumstances. Conflicts are hard to avoid, unless one concentrates on the tail end of the system or on small independent systems. However, even so the changes introduced by the new structures would have had to be preceded by intense consultation with the landowners in different command areas. When the spate systems in Balochistan were constructed, however, no consultation took place.

In Balochistan the role of the Irrigation and Power Department stopped very much after construction. After care was primarily limited to the posting of linemen and guards. There was no routine program for repair works, but repairs were done on an ad hoc basis. In the last five years, however, the already inadequate budgets for maintenance by the Irrigation and Power Department have further curtailed. Precise figures on maintenance requirements and actual expenditures on spate systems are not

[2] Examples of spate irrigation systems that were not fully utilized because of disputes on the water rights are Uthal Kantra (Las Bela District), Ahmadzai (Zhob District) and Safi Band (Loralai District). One system in the Anambar Plain was even blown up with the consent of the two conflict parties.

available, but the overall estimated shortfall for the operation and maintenance of irrigation and drainage structures ranges between 25-75%.

Against these budgets and budget requirements, there is no dedicated revenue. Water tax, collected in perennial canal systems by the Revenue Department, is not levied on spate systems in Balochistan. Farmers in spate irrigated areas are bound to pay land revenue and other smaller land based taxes, though. The returns are modest (in the order of US 1.5/ acre) due to the low per area rates, underassessment and decreased collection efficiency.

It is fair to say that the overall lasting impact of the public investment in new spate irrigation structures in Balochistan has not been very large. A government program that had a far larger impact however was the bulldozer subsidy program. Under these subsidy program bulldozers and frontloaders, that were provided under several aid programs, were rented out by the Agricultural Engineering Department for Rs 100-150 per hour (US $ 5-7.5). The allocation of these quotas was done by elected politicians; the political mileage that was made is testimony to the popularity of the bulldozer subsidies. The impact of the bulldozer subsidies on the rehabilitation of the flood irrigation structures has been significant and the bulldozers were used to rehabilitate and reinforce bunds and flood channels as well as construct new ones. The bulldozer subsidies also had an important impact on the social organization of the floodwater users: they removed the need to pool resources to maintain the structures. The bulldozer subsidies program however is now in decline. Several of the bulldozers are now out of order and under the subsidies no provisions were made for their replacement.

In the absence of a pervasive role of the government, the spate irrigation systems in Balochistan are by and large farmer-managed. Some of these systems in fact represent some of the world's largest farmer-management systems. The most spectacular system is the series of earthen bunds on the Nari River in the Kacchi Plains, irrigating over 50,000 ha. Management of the spate systems requires arrangements for the internal water distributions, the management of the sediment transport, the organization for maintenance, reinforced by water rights. These various management functions are discussed in the subsequent section.

4. Farmer management in spate irrigation

The three main functions in the management of spate irrigation systems are:

- the distribution of spate water
- the management of silt and scour processes in the flood channels
- the maintenance and rehabilitation of diversions structures.

This section describes how farmers manage these functions as well as the type of water rights and the type of farmer organizations in place.

Distribution of spate flows

The risks in flood irrigated agriculture are high, but the probability of being irrigated or not is not equally distributed throughout the command area of the flood irrigation systems. Within the area served by one flood river and within the command area of one off-take, there may be land with high, medium and low probability of irrigation. This probability depends on the location and level of the command area along the flood river. Often upstream land and low lying land takes precedence and in Balochistan one will typically find a flood channel with a series of small and big obstructions, forcing the water to irrigate sub command areas in stages from head to tail. Much depends, however, on the ability to control the floods: where the flood channel is deep and its bed is rocky and steep, management and control of floodwater is far more difficult. Obstructions will not stand up in high floods and a 'free distribution' will be in place, where water finds its own way through the command area, with low-lying

areas having the largest probability of irrigation[4]. Yet if floods are moderate, a sequence of water deliveries from head to tail can be practiced.

The point to be made is that, unlike perennial systems, the distribution of the floodwater is not entirely in control of farmers. Nevertheless in most spate systems in Balochistan there are water allocation rules in place that modify the probabilities of irrigation. Between off-takes, there may be rules on when to close an intake or break a barrage. Within the systems, an important allocation rule is the right to a second irrigation. It is either at the discretion of an upstream landowner to divert water for a second time, or alternatively he can only avail of it after all tail-enders have been served. The latter rule clearly spreads the probability more evenly[3]. The spectrum of water allocation rules is given in box 1. These allocation rules reduce - to some extent- the antagonism and mitigate the inequity. This is important, as farmers are dependent on one another in the maintenance of the works and too much unfairness would be dysfunctional.

Box 1: Water allocation rules in spate irrigation

- the construction of diversion structures and obligations to break them;
- the rights of some land tracts against others to be irrigated, when spate flows are small;
- the sequence in which lands are irrigated and the proportions to go in the different flood channels;
- normative rules on water usage, like the entitlement to a second turn and the depth of water to be applied; and
- agreements on the disposal of the high and unusable floods.

Managing sediment transport

Scour and siltation are part and parcel of spate irrigation systems in Balochistan. Rivers in spate lift and deposit huge quantities of sediment. As a result there is constant change in bed levels, resulting in changes in bed levels and water distribution. The impact of these processes differs between the various systems. It depends on the amount and composition of the sediment load that a river carries, which depends on the rainfall pattern and the characteristics of the catchment area; its geology, morphology and vegetation cover. Farmers are usually able to identify the origin of a flood by the type of sediment that is transported by it. The degree of siltation and scour also depends on the local topography and the type of material. In spate irrigated areas with low gradients, as are found on the plains, a river is always in danger of choking itself with its own silt deposits and finding another way. Moreover, in the fine sandy deposits of the plains, the scouring of the riverbed is a larger danger than it is in the rocky and pebbly riverbeds of the highlands of the Balochistan. As a result, the lowland flood irrigation systems are particularly dynamic.

Farmers, however, are not passive actors in these scour and siltation processes. They actively manipulate land formation. They may deepen the headreach of a flood channel, in order to attract a larger flood that will further scour out the channel. If a flood river breaks its banks, farmers may close

[3] The internal differentiation of the flood irrigation systems in Balochistan has other consequences too. One consequence is that the cultivated fields receive their irrigation at different times. In particular, in an elongated flood season, the high probability lands may be supplied from the early floods, whereas others rely on later floods. Crop choice is determined by the timing of the first irrigation and the result is often a 'banding' of the command area. Typically, in systems dependent on monsoon rainfall, an early summer flood may have been devoted to an area under sorghum, with oilseeds and pulses gaining popularity later in the season. The last summer floods are often reserved for wheat. The consequence of the variation in crops is that planting and harvesting activities are spread out and as a result there is considerably exchange of labour. It also allows the farmers whose land did not receive a single watering during the season to survive.

the breaches, if it deflects water away from their land or on other occasions, they will leave the breaches intact, so that these will act as escapes, creaming off the peaks of the very high floods and maintaining the flow at their own system at a manageable level. In other cases farmers will manipulate the siltation process to force the riverbed to purposely silt up. The latter is in practice where the river has become uncontrollable, because its bed may have become too deep or too steep. The remedy is to built a strong permanent bund across the river and force the river to deposit its sediment load upstream of the bund[4].

In Balochistan these land formation processes are managed by farmers. This is unlike the spate irrigation systems on the eastern slope of the Suleman Range (DI Khan and DG Khan) in NWFP and Punjab Province, where the civil administration actively intervenes in instructing farmers to plug breaches and to connect flood channels. During the colonial times the rights to the spate flows were registered and since then disputes are resolved through a special functionary. In Balochistan there is only limited involvement by the government in supervising the timely breaking of the bunds in the main Nara system as well as in the major flood channels. This is done through the office of the so-called tehsildar gandajat, a leftover from the period when the Kacchi Plains were ruled by the Khan of Khalat. This supervision has lost much of its force now and is now often limited to conflict resolution.

Organizing the maintenance of diversion structures

Maintenance arrangements have to cope with the inequities between areas with low and high probability of irrigation. Moreover, in spate systems returns for some farmers (in areas with a very low probability) are so low that their contribution to the maintenance of the systems is hardly matched by the marginal benefit they derive from it. This is unlike perennial irrigation systems, where the value of water is almost always far in excess of the maintenance efforts.

Notwithstanding these difficulties, in many spate irrigation systems maintenance and rehabilitation is vital: without it there is simply no irrigation in a subsequent year. This is unlike perennial systems, where often more neglect is tolerable. This places a high demand on the organization of farmers, complicated by the unavoidable inequity in water supplies.

In response to these challenges, in almost all spate systems clear rules have developed on the contribution of individual farmers. There are broadly two types of systems in this regard. The first category of systems is the 'regulated' systems. In a regulated system the area that is entitled to spate irrigation is clearly demarcated. The question is how do farmers within these areas contribute, given the fact that some areas stand a far better chance of being irrigated than others. There are two extremes:

- only farmers that had their land irrigated contribute to the maintenance of the system.
- all farmers contribute in proportion to the land that is entitled to spate flows, irrespective of the probability of the spate flow;

The first option may seem fair, but does not work in practice and also does not occur in Balochistan. It does not work, because it provides too narrow and unpredictable of basis for the maintenance work. Who remembers which land was irrigated the previous year? What if the diversion structure is destroyed before anyone watered his fields?

[4] The strategy was followed when the large Sonwa Bund was built. This bund was erected at the tail of the Nari River, the largest flood river in Balochistan. The idea was that because of the permanent bund the riverbed would silt up. With the rising riverbeds, high level inundation channels would come under command again. This would skim the peaks of high floods and would reduce the impact of a high flood on the main bund. If the riverbed were higher, it would also serve those intakes dependent on deflectors and barrages, because it would become easier to build these structures. Eventually though, the danger is that the river will silt up so much that it breaks through its banks or scours out a flood channel to create a new course for itself. This, in fact, eventually happened with the Sonwa Dam. Farmers usual reasoning in such a case, however, which is indicative of a dynamic perspective on the sustainability of the spate irrigation systems, is that even then it is easier to control the floods than it was in the old deeply eroded river course.

The second extreme on the other hand is straightforward: every one contributes to the land in the designated command area. However, it puts a disproportional burden on farmers in areas with a low probability. One often finds, therefore, in systems where maintenance is organized on this principle, that water distribution rules are in place that favor the low probability areas (such as no second irrigation and the following of strict sequence of water turns). Or, particularly in small systems, land tenure may be such that farmers have land both of high and low probability. A different route is that of dispensations in the labor or cost contributions for deprived farmers. One such dispensation is that persons who have bullocks or tractors are expected to take these along during the maintenance works, whereas other farmers only provide labor. Bullock or tractor owning farmers are often those that have a disproportional part of their land under cultivation, and in this way fairness is restored. In larger systems maintenance is often done by labor contributions, but financed out of a special water tax (gham). Often different rates are assessed on different parts of the command area. For areas with a low probability a lower tax is assessed. However, such compensation rules are not in place everywhere.

The opposite of the regulated systems described above are the voluntary systems. In these systems the area that is irrigated from spate flows is not predetermined. The rules are essentially based on a 'take it or leave it'. If one contributes to the repair of the structures, one is entitled to the flow. If one does not contribute, the field intake is closed. These voluntary systems can be very unfair on low probability landowners, as there is no dispensation. In some cases in fact, the tail enders contribute more per acre. Where deflector spurs are rebuilt a number of times, one may find tail enders contributing to several rehabilitations before they get the water.

Reactive water rights

There is a categorical difference in the water rights in spate diversion systems and perennial systems (Varisco 1983). Whereas in perennial systems in Balochistan, individual rights are often sharply defined in fixed proportions of the flow and the allowed usage time, water rights in flood systems are 'reactive'. They cope not only with the unknown proportions of the next flood[9], but also with the medium-term changes in the river morphology, due to scour, siltation and change of river course. Water distributions in the floodwater irrigation systems are based on allocation rules rather than alienable property. They describe what is 'done' and what is 'not done'. The spectrum of possible rules is given in box 1.

A second domain regulated by reactive water rights concerns the changes in the layout of the systems, as a result of natural or man-manipulated siltation or scour. Water rights may accept the changed circumstances or may try to restore prior access to the water. This also depends on the nature of the change.

In most - especially smaller - systems in Balochistan, water rights are enforced indigenously, by the farmers of the flood irrigation systems. Where conflicts occur, outside political or administrative support may be mobilized, but essentially the distribution of water and repair of irrigation infrastructure is not a government responsibility. Its involvement is limited to extend help on an incremental basis, at varying degrees of intensity, keeping in line with political principles of patronage, and divide and rule.

In fact, the only time when a government was directly involved in the management of spate irrigation systems in Balochistan was during the latter period of Kalat State, when the native ruler appointed the so-called tehsildar ghandajat, who was to supervise the breaking of the different barrages in the Nari River at a specified time. As discussed, the background of this practice was that otherwise the ruler's own land at the tail of the system might not be inundated. Yet this regime of regulated flood management was exogenous to the resource, and disintegrated when the political constellation changed. After Kalat State joined the newly formed republic of Pakistan in 1948, the former administration of the water rights was dismantled, and the upstream landowners refused to break their barrages after the previously specified time. In the ensuing vacuum, water rights were often determined by the relative

strengths of the communities along the flood river rather than by formal regulation. In contrast, in the flood irrigated areas of Punjab Province of Pakistan, government involvement has been more persistent. In the colonial period the British administration, in order to safeguard the land revenue from the flood irrigated areas of Punjab, directly managed the use of flood water, and organized the repair of bunds and flood channels by corvee labor and posted watchmen, who were to break the barrages in time (Bolton 1908). The system has slackened somewhat, but still the District Collector supervises the water distribution and timely breaking of earthen bunds in this area (PARC / UNEP / ESCAP 1994).

Farmer organization

Who organizes the maintenance work and who supervises the water distribution in the spate system in Balochistan? In general, given the magnitude of the task, the work is organized in a surprisingly informal way. A number of influential farmers take the initiative. These are often farmers with large holdings, who stand to gain most from the reconstruction of the structures and also have most resources to mobilize fellow-farmers. The maintenance is done in a campaign mode, with a series of days planned for joint labor. In some of the large spate systems on the Kacchi Plains, a water tax (gham) is still collected through a network of local leaders. Alternatively the influential farmers try to arrange the subsidized bulldozers to their areas. In fact the arrival of the subsidized bulldozers has removed the need for structured farmer organization. In summary there are organized farmers and clear rules, as described above, but no farmer organization as such.

In some of the larger lowland systems specialist staff is deployed. They are of two types. In the Kacchi Plains designated 'engineers' supervise the construction of the large earthen bunds. During the flood season they are engaged to patrol the safety of the bund. They are paid either in kind or from the gham. This office of 'engineer', however, is not common in all the spate systems, not even in the Kacchi Plains.

A second type of dedicated staff is the 'sepoys' (literally: policemen) engaged in a limited number of spate systems in Las Bela. Their role is to mobilize, if necessary by force, farmers to contribute to the reconstruction of the diversion structures. One finds the sepoys particularly in systems based on deflector spurs, where the burden on tail-end farmers (and hence the reluctance to contribute) is relatively large. The root of this position is the pre-partition time, when the native ruler organized the construction of the diversion structures with forced labor. His interest at that time was the land revenue that he received from a well-functioning spate system. After the dissolution of the princely state, farmers valued the role of the sepoys and continued their engagement. Again, however, the position of sepoy is far from uniform in spate systems.

Remarkably in none of the spate system dedicated persons are engaged to supervise the distribution of water, unlike the perennial systems in Balochistan, where often water bailiffs (called mir-i-aab, rais or sharistra) supervised the irrigation turns of the individual farmers[5]. No such position is in place in spate systems and instead social control by individual farmers regulates the water distribution. The reason is probably that it is difficult to do it otherwise: when the spate comes, so many areas are irrigated in a very short time that it is impossible for a specialist water bailiff to patrol.

5. Participatory spate irrigation management in Balochistan: options

As most of the spate systems in Balochistan are de facto farmer-managed, the scope for irrigation management transfer in Balochistan is limited to probably 25 functional structures. The question however is whether in all these 25 cases the 'pucca' structures are what farmers would rebuild, if flood

[5] The function of water bailiff has disappeared in many perennial systems with the introduction of watches, which made it unnecessary to engage a specialist to read sundials, stars and water clocks to supervise the water distribution.

damage would require so. It is more likely that farmers would prefer a menu of earth moving interventions to restore their diversion structures: the operation of heavy tractors and bulldozers is technically less demanding and can be undertaken at lower cost. The conclusion could be that several of the spate works will last as long they will last, but once gone will not be restored in the same shape under farmer management.

Leaving aside the management of the spate systems, constructed earlier with public funds, there is however a large scope for improved participatory management of the spate systems of Balochistan. The improvements concern the type of organizations and the type of spate water management. Most of the systems are managed in a rather passive way, with campaigns to rally contribution for O&M (if already bulldozers have not been secured in sufficient quantity) and rules on what to do and what not do in water distribution, but no local planning.

Strengthening of farmer organizations and assigning them planning and active management functions should be done in the light of a river management approach. The flood management system in D.I. Khan District of Punjab in Pakistan may serve as an example (Bolton 1908). Under this approach, rather than controlling the river, one tries to manage it in its entirety. This requires a more comprehensive look at the river system and the land formation processes. Examples of interventions are: controlling breaches in the river banks by making bunds in the newly formed spillways, if necessary in stages; forcing a degrading river to silt up by blocking it with a permanent bund, even if it means that the river may eventually find a new route away from the bund; excavating new flood channels to link up braided streams. These interventions mainly involve earthmoving and resemble existing farmer techniques of manipulating siltation and scour. This 'management' approach is less capital-intensive and has a far higher chance of creating sustainable flood irrigation systems, and as such is a superior alternative to past approach of building heavy headworks at single points.

Wherever possible, farmers should continue to be the prime implementers under the river management approach. When subsidized government bulldozers continue to be made available in Balochistan, a river-level management approach allows one to use them strategically, instead of letting bulldozer allocations be solely determined by political opportunism and individual demands. Two large spate irrigation systems were completed in the Kacchi Plains (with the help of NGO's) on this formula, from which valuable lessons can be learned. The first dam is the Rehanzai Bund using water from the Bolan River and an offshoot of the Nari River. This two kilometer wide earthen dam was made by farmers organized in village organizations and has been very successful in rehabilitating an area that had not been cultivated because the river has braided. Part of the success was at the detriment of down stream water users, who, despite formal assurance, were deprived of water, as farmers on one of the flood channel of Rehanzai refused to break their bunds. This underlines the need for a river basin approach. The second example is the Sonwa dam, built at the tail of the Nari, planned and implemented by the farmers on the three main flood channels benefiting from the three kilometer wide bund. Unfortunately the bund broke after two very productive years and was not rebuilt by the farmers, who instead are using part of it. This example also shows that one should not expect miracles from farmer organizations.

While the techniques are not new, the most important crucial element in a river basin management approach is the appropriate organizational framework. Since the interventions involve changes that affect several intakes simultaneously, an institutional structure is required that supersedes the interests of the land owners on a single flood channel, and avoids decisions that are taken by a show of strength only. The challenge is to have a supra-local organization with a permanent character, since - although it may be intermittent - management never stops and the build-up of knowledge on the river's behavior is essential.

The new Balochistan Irrigation and Drainage Act, accepted in 1997 has the provisions for this. The Act was prepared as part of the institutional reform in the water sector, that is meant to create financial autonomy. One important step in this regard is the transformation of the Irrigation and Power

Department into an autonomous Irrigation and Drainage Authority with responsibilities for surface and groundwater management. The Authority can under the Act delegate its responsibilities in water management and revenue collection to Farmer Organizations. These Farmer Organizations are formed on the basis of hydraulic units and can federate. At present the hydraulic units specified are distributaries and minors of large canal systems. This should be corrected. More work needs to be done on the Act: the legal status of the farmer organizations and the procedures for registering them are not yet worked out. The first step however is to put the Act in its current shape in practice, which is not yet done.

A second legal reform that is overdue is the codification of spate water rights. Water rights are only recorded on two flood rivers, i.e. the Porali and the Nari. The competition for water will only increase and with it the risk of depriving downstream water users. The codification on the Porali has led to a conflict-free distribution of water on this river. In case of the Nari, the rules on the breaking of the bunds is not always enforced. Even so, without these rules the chaos would have far larger.

References:

Bolton, H.N. (1908). A report on irrigation in Dera Ismail Khan. Reprinted in: BARD Rod-kohi agricultural problems and prospects symposium, November 27-29 1989. Islamabad: Pakistan Agricultural Research Council, 16-37.

Brunner, U. and Haefner, H. (1986). The successful floodwater farming system of the Sabeans, Yemen Arab Republic. In: Applied Geography, 6, pp. 77-86.

Buzdar, N,, Nagy, J.G., Farid Shabir, G., Keatinge, J.D.H. and Khalid Mahmood (1989). Rainfed agriculture in highland Balochistan: a farming systems perspective. Research Report 54. Quetta: Arid Zone Research Institute.

Camacho, R.F. (1987) Traditional spate irrigation and wadi development schemes. In: FAO/UNDP Spate irrigation: proceedings of the subregional expert consultation on wadi development for agriculture in natural Yemen, 6-10 December 1987.
Rome: FAO, 60-72.

Girgirah, A.A., Maktari, M.S., Sattar, H.A., Mohammed, M.F., Abbas, H.H. and H.M. Shouhibi (1987). Wadi development for agriculture in PDR Yemen. In: FAO/UNDP Spate irrigation: proceedings of the subregional expert consultation on wadi development for agriculture in natural Yemen, 6-10 December 1987.
Rome: FAO, 9-26.

GROUNDWATER CONSULT (1991). Balochistan flood water irrigation systems. Islamabad: Royal Netherlands Embassy.

Khan, Aminullah (1979). Hill-torrent (rod kohi) control scheme for the Daman tract of D.I. Khan District. In: National seminar on land and water resources development of barani areas. Lahore: CEWRE, 80-87.

Khan, Amir Nawaz (1987). Spate irrigation in Pakistan. In: FAO/UNDP Spate irrigation: proceedings of the subregional expert consultation on wadi development for agriculture in natural Yemen, 6-10 December 1987. Rome: FAO, 167-170.

Morton, J, and van Hoeflaken, H. (1994). Some findings of a survey of flood irrigation schemes in Balochistan, Pakistan. IMN Network Paper 31. London: ODI, 1-9.

IAN MACDONALDS AND ASSOCIATES (1987). Diagnostic study of farming systems in Baluchistan: Kacchi. Quetta: BAERP.

IAN MACDONALDS AND ASSOCIATES (1987). Diagnostic study of farming systems in Baluchistan: Las Bela. Quetta: BAERP.

Makin, M.J. (ed) (1977) Yemen Arab Republic: Montane Plain and Wadi Rima Project: a land and water resources survey. London: Ministry of Overseas Development.

Maktari, A. (1971). Water rights and irrigation practice in Lahj. Cambridge: Cambridge University Press.

Mu'Allem, S.A. (1987). Crop production under spate irrigation in the coastal area of PDRY. In: FAO/UNDP Spate irrigation: proceedings of the subregional expert consultation on wadi development for agriculture in natural Yemen, 6-10 December 1987. Rome: FAO, 167-170.

Mundy, M. (1985). Agricultural development in the Yemeni Tihama: the past ten years. In: B.R. Pridham Economy, society and culture in contemporary Yemen. Exeter: Centre for Arab Gulf Studies, University of Exeter, 22-40.

Munir, M. and Muhammed Akram Kahlown (1988). Sailaba irrigation in Baluchistan: bench mark study. Lahore: WAPDA Planning Directorate (South).

NESPAK (1993) Feasibility studies for development of rod kohi schemes in DI Khan. Lahore: NESPAK.

Serjeant, R.B. (1964). Some irrigation systems in Hadramawt. In: Bulletin of the School of Oriental and Africa Studies, 27, 33-76.

Shah, S.H. (1989). Cropping patterns in rod-kohi agriculture in D.I. Khan. In: BARD Rod-kohi agricultural problems and prospects symposium, November 27-29 1989. Islamabad: Pakistan Agricultural Research Council, 115-121.

Varisco, D.M. (1983). Sayl and ghayl: the ecology of water allocation in Yemen. Human Ecology, 11, 4, 365-383.

Wildenhahn, E. (1985). Traditional irrigation systems in the Southwest of Saudi Arabia. In: J.F. Mock. Traditional irrigation systems and potential for their improvement. Hamburg/Berlin: Verlag Paul Parey:119-134.

4. Field-to-field flood irrigation, as common in Yemen, is unusual in Balochistan. In Balochistan each field typically has its own inlet channel.

9. Similarly, in perennial systems different allocation rules exist for different discharges. Often in case of high seasonal discharges, water allocation rules are not in strict accordance with water rights.